POPULAR MECHANICS

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THE BEGINNING OF THE HORSELESS AGE

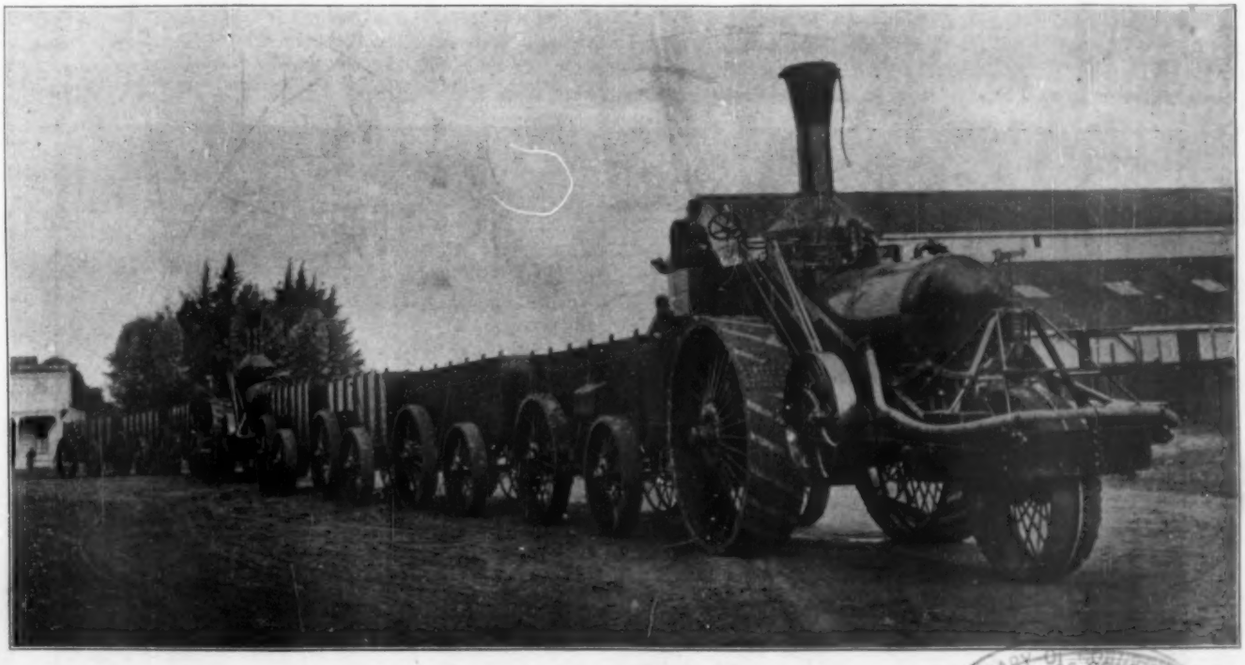
Large Cash Prizes Offered for Improvements in Road Engines

We have already crossed the threshold of the horseless age. Not that the time will ever come when the inborn love which man possesses for the horse will cease, nor horses entirely disappear from boulevard, and town and farm; but henceforth machinery will perform the heavy work now done by animal power, just as the harvesting machine has taken the place of the sickle. The largest displacement of horses thus far was when street railways adopted electricity to operate their cars. To do the work performed by the trolley cars of the United States today, would require not less than 300,000 horses or mules, and these would have to be replaced every four years.

Automobiles propelled by steam, gasoline and electricity are already in use by thousands, and that village is far remote where at least one of these flying roadsters has not been seen. This week we illustrate several types of machines built for practical work.

IOWA ENGINE ON HIGHWAY.

California is a state of magnificent distances. Its railroads are few and far between as yet. To reach the nearest shipping point hundreds of farmers must team the grain and other products of thousand-acre farms many miles. This has resulted in the construction of thousands of miles of the finest highway in the country. Many of these roads are kept sprinkled at public expense for seven months in the year. The common method of hauling is in wagon trains of six or more big wagons, fastened one behind the other, and drawn by 16 to 20 horses. Two men constitute the crew. Travel is mostly by night when the air is cool. One of these trains carry upwards of 25 tons, and make three to four miles an hour.



CALIFORNIA WAGON TRAINS READY TO LOAD.

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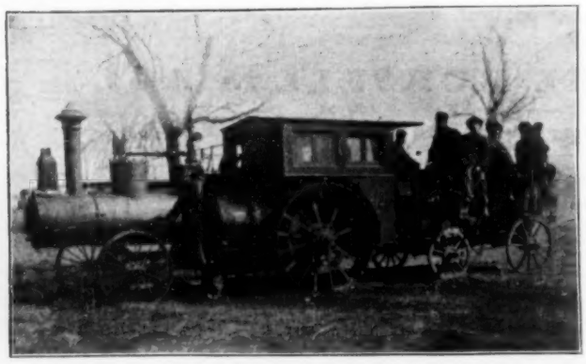
SMITHSONIAN

To save time, expense and to travel night and day, road engines weighing 10 tons each and capable of drawing 40 tons at five miles an hour are being made. The California wagon train illustrated herewith is drawn by one of these engines built by the Best Manufacturing Co., at San Leandro. It burns coal, carries its own supplies of coal and water and is controlled by an engineer who steers the train from a high seat. The fireman stands on a lower platform, stokes the fire and keeps plenty of water in the boiler. By using two engine crews the train can be in motion night and day and make 120 miles in 24 hours. The



IOWA ENGINE AND CREW.

direction the train will take is determined by turning the single front wheel to the right or left.

An Iowa builder, J. A. Wicke, at Van Horne, is also working along the same lines and is building a road engine of a somewhat different type. It also burns coal but carries supplies in a tender. This engine runs on four wheels, the front pair for steering and the large pair for traction. The machinery is housed in a cab very like a locomotive, which with its headlight and smoke stack it somewhat resembles. These engines have already been used in hauling loads, plowing through snow drifts to open up country roads, and other heavy work. One illustration shows it returning with a crew of men; the other drawing a small grainery which is mounted on rollers. Its wide wheel-tires enable it to climb hills, and cross streams where the bottom is not too soft.

Another illustration shows a good-sized house being moved at Shelbyville, Ind., by a traction engine built by the Marion (O.) Manufacturing Company. This machine exerts 20 horsepower, steers with the front wheels, has engine geared to the rear wheels, is started and stopped by means of a friction clutch, has two speeds, whistle and steam gage. It will run in either direction.

The Government of Great Britain, which is using traction engines in the movement of army supplies in South Africa, offers a first prize of $5,000, a second of $3,750 and a third of $2,500 for the best traction engines. Winners must haul a load of 12½ tons along a good level road for a distance of one mile at a speed of eight miles an hour.

MAKE BEER FROM RICE IN EUROPE.

Malt from rice is a late invention which threatens to revolutionize the manufacture of beer in Europe because of its cheapness. The inventor is Eugene C. Schrottky, of Dresden. The unshelled rice is put into water-tight vats provided with a false perforated bottom and with inlet and outlet for water. The product is allowed to soak and steep under several changes of water at a certain temperature. U. S. Consul Charles L. Cole, who has made an official report on the process, says:

"At the end of five or six days treatment, nearly every grain of the rice will be found to have germinated and the sprouts will have grown about twice as long as the rice grains."

After the final development the malt may be dried in the usual way or used at once as "green" malt for the manufacture of beer, spirit or glucose.

A PLAIN CASE OF HORSE SENSE.

The old horse Dick, who went down into the fog-obscured waters of San Francisco bay when the San Rafael sank, was found quietly grazing on Alcatraz Island two days later. The question at once arises, what intelligence it was in that horse that enabled it to swim to land unerringly in the fog over a distance of a mile or more of water? Not a passenger on board with the horse had the least idea in which direction land lay. Not an officer on either steamer, trained seamen as they were by years of service, knew the exact location of the wreck and in which direction lay the nearest land. Only this poor old horse had sense enough to know where land was and to swim to it. The higher animals, the more acute intelligences, which were his fellow passengers, would every one have perished had they been thrown into the water dependent upon their knowledge of the location of the island, even had they possessed the strength to swim to it when known. Man has civilized himself out of this instinct, but the horse has not. He has plenty of horse sense left.

HOUSE MOVING AT SHELBYVILLE, IND.

WORLD'S LARGEST CHICKEN FACTORY.

Machinery Does Everything in this Place Except Lay the Egg.

Sidney, Ohio, boasts of the largest "chicken factory" in the world. It is called the Mary L. Poultry plant and is named for the winsome daughter of John Loughlin, the owner. The only part the hen plays in the production of the 300 chickens killed here each day is to lay the eggs. The plant is valued at $100,000 and the sales average $41,000 annually. The two principal buildings are the hatchery and the egg house.

The hatchery is horse-shoe in shape and 840 feet around. The chicks from the day they are hatched begin a circuit of this curved building, advancing a pen each day. When they are 90 days old they reach the last pen, which is the killing room. Here head downward they meet their doom. The wholesale slaughter is by the usual method of suspending by the legs. There is a quick cut across the roof of the mouth to sever the veins, the brain is pierced with an awl and the chicken passes to the "pinner," who prepares it for the market.

The machinery employed in this establishment is novel as it is original. The boiler room, where steam is made for heating the brooder house, says the Reliable Poultry Journal, is in the front end of the basement. The incubator room contains 300 incubators. They are heated by natural gas, which is used exclusively in the plant. Thirty incubators run steadily at full capacity, 450 eggs each, the capacity of 1½ incubators being hatched each day. One incubator is set one day and two the next.

The newly hatched chicks, from the time they break the shell, begin their 90-day journey to the killing room. They are taken from the incubator and put in a broad cage, placed on a handcar. On this they ride to the elevator, which lifts them to the nursery floor above. There are 30 pens in the nursery. The floor of the pens of the first third of the nursery are covered with a canvas carpet to prevent the baby chicks from gorging themselves with the gravel on the floor. The carpets are taken up and washed clean every second day.

There are 60 pens in the brooder house, making 90 in all, one pen representing each day of the chicken's life. The change from large to "squab" broilers made at certain times of the year cuts down the time of growth one-half; thus the day's output of chicks occupy two pens, and two pens come out into the killing room each day.

The egg house is 537 feet long with a four-foot aisle in the center. It contains 60 pens, 30 on each side of the aisle. In these are kept 3,000 Leghorn hens, which lay eggs exclusively for the market.

Nine hundred Plymouth Rock hens keep busy in the Plymouth Rock house laying the eggs for the incubators.

The hatchery and the egg house are both built of brick on stone foundations and have slated roofs. In the basement of the laying house are boilers and an engine to furnish power to the machinery for grinding and cutting food. The boilers are also connected with the steam pipes of the brooder houses, so that steam can be turned on from them in case of accident to the brooder house boilers. There is a boiler for cooking food, a mill for cracking or grinding corn, a power bone and clover cutter with other apparatus. The cracked corn is sifted into different sizes for chickens of different ages. About 250 pounds of green bone is cut and fed every other day. In the roof of the long egg laying house provision has been made to house 60,000 pigeons.

INTERIOR BROODER HOUSE.

GENERAL VIEW OF CHICKEN FACTORY.

WHAT'S COMING?

Did you ever see an Araba? They are curious looking things. We will show a picture of one in our next issue and tell you what it is.

One time heir as a little girl who w lowed her mother's hat pin An x-ray man looked into her, saw the pin and got it out. He took a photograph of the child while he was ooking at her. This same photograph will be published in our next issue and we will tell how x-ray photography is worked.

Just imagine the people of some American city burying a a little child alive under a church thinking it would keep the building from falling down! That's what they used to do; entomb them under cathedrals to placate the devil. Read about it in the next issue.

Often people are buried alive, when it was believed that they were dead. We will explain how to tell when a person is dead for sure, in the next issue.

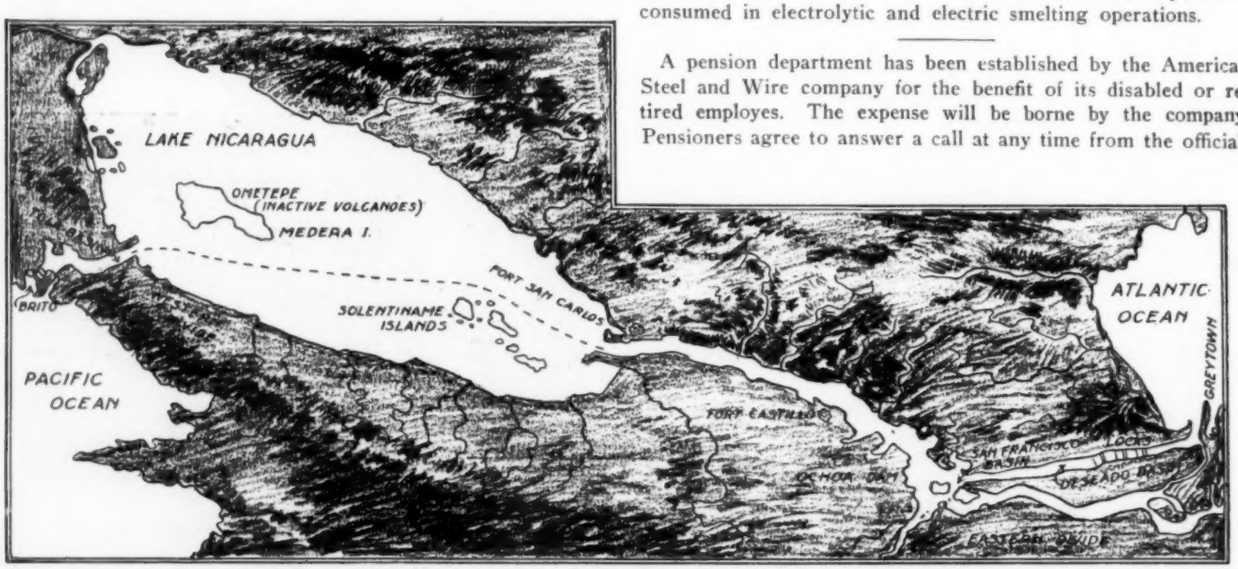
Did you ever see a locomotive blow up? One man who did is going to tell all about it in next week's Popular Mechanics.

How to prevent "sweaty" pipes; how chimes are rung, and a hundred interesting facts next week.

THE GREAT AMERICAN CANAL.

Merits Panama and Nicaragua Hold Out to Uncle Sam.

Shall it be Nicaragua or Panama? The great ditch which it is proposed to dig to divide the two Americas is a subject that is interesting every American. The French company which has failed in its efforts to construct the Panama canal is now trying to sell the partially completed channel to the United States. At first the company wanted $109,141,500, but now, according to report, they are willing to sell for $40,000,000. They say they were forced to this step to avoid ruin, which is inevitable should the United States decide to build the Nicaragua canal.



THE NICARAGUA ROUTE.

It is the current belief that it will take eight years to finish the Panama canal, besides two years for preparation. The Nicaragua canal can be finished in six years after the two-year preparatory period is over. The Panama canal is 49 miles long; the Nicaragua is 183.66. The Panama route would also have a lower summit elevation and less curvature. It would cost $1,350,000 less a year to maintain than the Nicaragua canal. It would take a draught vessel 12 hours to pass through the Panama canal and 33 hours to pass through the Nicaragua. Winds for sailing vessels and hygienic conditions favor Nicaragua. The Panama would be a shorter route for commerce to our Atlantic ports and to the west coast of South America. The Nicaragua would save a day between the Pacific coast and any port on the Atlantic. It would make the same saving between our Atlantic ports and China, Japan and the Philippines. It costs from $250 to $3,000 a day to operate an ocean vessel. Making the average $1,500 for each vessel, the Nicaragua canal would mean a saving of $15,000 a day to vessels bound going to and from these ports, on the supposition that only ten should pass through each day. This would amount to more than $5,000,000 a year.

The cost of building the Nicaragua canal from the beginning is estimated at $189,964,062. The cost of finishing the Panama canal is estimated at $144,233,358. Already about $300,000,000 has been spent on the Panama. The Panama route would carry with it little or no commercial development, but would be simply a means of communication between the two oceans.

The McCormick Harvesting Machinery Company is shipping 800 car loads of harvesting machinery to ports along the Black sea, later to be distributed in Southern Russia. It will require three steamships to transport the shipment which is said to be the largest ever made from an American port. The machinery is from Chicago.

A gentleman recently inserted a small notice in a Chicago daily for a young man to act as his valet at $30 per month during a trip to Europe. The first day he received 600 replies and 200 the second day.

The present total output of electricity at Niagara is about 50,000 horse-power. Of this no less than 23,200 horse-power is consumed in electrolytic and electric smelting operations.

A pension department has been established by the American Steel and Wire company for the benefit of its disabled or retired employes. The expense will be borne by the company. Pensioners agree to answer a call at any time from the officials of the company to give advice regarding the works of the department they were connected with.

The old whaler "Progress," which was exhibited at the World's Fair, has now been blown up with dynamite to clear the channel of the Calumet river where it had sunk and obstructed navigation.

At a recent food show in Chicago one of the attractions was a diver who remained under water in a large tank for hours at a time, and conversed with visitors by means of a telephone inclosed in his helmet.

The Negro World's Fair Company has been organized in Alabama, and is now on the lookout for a city with enterprise enough to furnish the revenue and become the site of a fair which it is proposed will be an exposition of the progress that has been made by the Negro race.

Special editions of all the great newspapers of the world will be printed at the world's fair grounds in St. Louis if the scheme of Gen, Harrison Gray Otis proves a success. He proposes to secure the cooperation of all the leading dailies, and establish a monster newspaper plant at the exposition.

Three thousand dollars has been appropriated by the Philadelphia city council to be awarded for the best design for the soldiers' monument which it is proposed to build at a cost of $500,000 in Logan Square. A plan of competition has been drawn up by the T Square Club of that city.

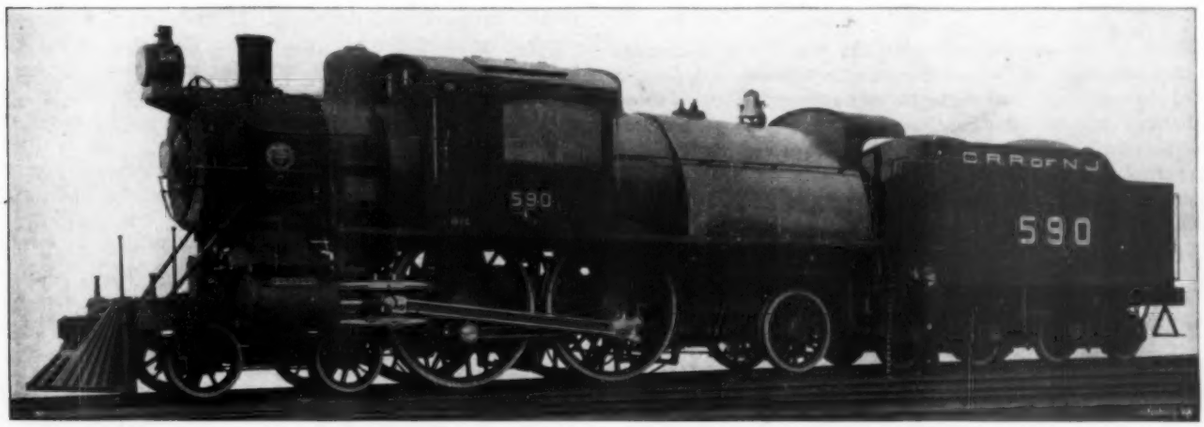
A new submarine cable between Horta, Island of Fayal, Azores, and Waterville, Ireland, has been laid by the Commercial Cable Company of New York. This increases to four the number of cables operated by the same company between Canso and Waterville. New York will be benefitted by the new line as Waterville is connected by submarine cable with Havre.

LATEST IN PASSENGER LOCOMOTIVES.

Queer Looking Monsters in Service on the Central of New Jersey.

Three new passenger locomotives of the Chautauqua type, made by the Brooks works of the American Locomotive Company, have just been placed in service on the Central Railroad of New Jersey. The engines are designed to burn small anthracite coal. A description of the engines in The Railway Age, contains some interesting figures. Their weight on the leading wheels in 48,400 pounds; on the driving wheels, 99,400 pounds; on the trailing wheels, 43,200 pounds—total weight, 191,000 pounds. They have a heating surface of 2,793 square feet in the tubes and 174 square feet in the firebox. The firebox is 123 inches long and 97 inches wide. The grate area is 82 square feet. The ratio of adhesive weight to tractive power is 4.33.

The cylinders are 20½ in. in diameter; driving wheels 85 in. in diameter; piston valve 11 in. The boiler is a radial-stayed wagon-top of the Wooten type, 68 in. in diameter at the smallest ring. It contains 325 tubes, 2 in. in diameter and 16 ft. 6¼ in. long, and carries a working pressure of 210 lb. The tender is of 6,000 gallons water capacity and will carry 12 tons of coal.



PASSENGER LOCOMOTIVE FOR THE CENTRAL OF NEW JERSEY.

BOY'S AUTOMOBILE.

Mrs. George Jay Gould's Christmas present to her son George Jr., a 9 years lad, was a miniature electric automobile, complete in every particular. Its dimensions are: Length over all, 4 ft.; body, 3 ft. 3 in. by 1 ft. 7 in.; height to seat, 2 ft.; weight, 200 lbs.; wire wheels, 20 in. rear, 16 in. front; tires, 1½ in. pneumatic; battery, 10 cells, developing ¼ horse-power; three-speed lever, 5 to 7 miles an hour for 20 miles without recharging.

BAKERY NO LODGING HOUSE.

In London there is a law prohibiting sleeping in a bakehouse. This law has been in effect a number of years and its object is to keep tramp bakers from using the bakehouse as a sleeping apartment. The law has been rigidly enforced, but recently a baker was arrested for taking a quiet hour's sleep in his own shop. He was arraigned and discharged, but it goes to show that efforts are being made to insure cleanliness and good air in the baking quarters of the London bakers.—Confectioners' Gazette.

Please show Popular Mechanics to your friends.

WORLD'S FAIR EMBLEM PRIZE.

Twenty-Five Hundred Dollars Offered for the Right Idea.

A prize competition open to the world for a symbol or emblem for the Louisiana Purchase Exposition, to be held in St. Louis in 1903, has been set on foot by the Louisiana Purchase Exposition Company.

The symbol or emblem is to be used for the seal, the stationery, and for publicity material of every description for the Exposition. For the conduct of the competition an appropriation of $5,000 has been made, of which $2,500 is to be given for the prize design.

EXCITEMENT OVER IRON DISCOVERIES IN ENGLAND.

Considerable excitement prevails in London commercial circles because of the discovery of new beds of a high quality of iron ore near the existing collieries. Many of the big firms in the north of England are spending vast sums of money in furthering the search, believing the discovery to be the secret of meeting the threatened invasion of that country of American iron and steels goods. Up to the present time many of the largest iron works have had to depend on Spanish and other extraneous supplies of iron ore.

POINTS FOR AMATEUR CANDY MAKERS.

With a little care excellent candy may be made either on a stove or in a chafing dish. When making candy the rules for boiling sugar should be carefully observed. When sugar reaches the candy stage the water has evaporated and the tendency is to return into the original stage of crystals, or if it is stirred, a thin line of crystals forms around the pan by the sugar rising while boiling and, if allowed to remain, the whole mass will granulate. Such particles can be removed with a small brush that has been dipped in water. The success of candy depends entirely upon boiling the sugar just the right degree. Candy will not harden if boiled too little. Another stage where it hardens, but sticks to the teeth means the boiling was arrested at the hard boil instead of the crack stage. Unless a thermometer is used a little practice is necessary before the small differences upon which success depends is noted.

A recent novelty for sportsmen takes the place of drinking cups, which are inconvenient to carry. The device consists of a small rubber tube two feet long with a nipple at one end and a filter at the other. It is very light and fits any pocket.

THE FIRST STEAM GAUGE.

In these days a steam boiler without its gauge would indeed be a curiosity. Yet there was a time when the first device for recording steam pressure caused great interest, and the Mechanical World, London, gives an illustration of the first gauge, which is carefully preserved as a most interesting relic. The diameter of the face is 6½ inches; the depth of the case 6¾ inches; distance from the top of the case to the bottom of the flange 9½ inches. With the exception of the flange the rest of the case was made in thick wrought brass. The dial is silver plated. The total length of the instrument, including the ½-inch iron syphon, is 23 inches.

It is widely known that this first steam gauge was fixed up and personally superintended in accordance with instructions received from George Stephenson, by the inventor himself—the late Sydney Smith—over fifty years ago.

The following memorandum has been found of the initial test:

"Early in the morning following the erection of the gauge the two nephews of George Stephenson (Messrs. Hindmarsh and Langham, who had then the management of the Tapton Collieries) came to see gauge at work, and as the pointer was moving round the dial, indicating the rise of steam in the boiler, these two young gentlemen put their ears to the gauge in order to ascertain if it was ticking, as in the movements of a clock."

RECIPE FOR LONGEVITY.

Ebenezer Matthews, of Wellsburg, Erie county, Pa., celebrated his hundredth birthday September 23. The occasion was honored by a large assemblage of his relatives and friends, to who the centenarian told how he had managed to live so long. He said:

"Live according to the Scriptures.
"Don't use tobacco.
"Abstain from the use of all intoxicating drinks.
"Take lots of exercise in the open air.
"Don't eat too much.
"Go to bed with the chickens and get up with them."

THE CARE OF MOLDERS' TOOLS.

A first-rate mechanic will take the best of care of his tools if permitted to do so, writes E. H. Putnam in the foundry department of The Tradesman. A dirty shovel is an expensive thing to the workman. It more than doubles the labor in using it. When the edge gets very thin in use it will turn up into a ragged roll, thus making a very thick edge, difficult to force through the sand heap. If there is an emery wheel or grindstone connected with the factory grind this "roll" or blunt edge off, holding the shovel blade at right angles to the face of the stone. Because you do not want a cutting edge upon the shovel—the blade itself is sufficiently thin, and the ordinary wear in use will sharpen it only too fast. Then clean the shovel, if necessary, fifty times a day. Have a well devised steel scraper, expressly for this purpose. It will not scratch the shovel, and is the best tool for keeping it clean.

When the keen end of the rammer gets worn thin get a new one, and be in a hurry about it. A thin peen enters the sand too deeply, does very little good, and adds very greatly to the work of the molder. I have seen a rammer in use the peen of which was worn down to an edge as thin as that of the shovel! A little reflection ought to teach the workman that such a tool is next to worthless.

This tool also should be kept clean and smooth. For the rammer is intended to pack the sand, and if incrusted with rust and dried sand, it will partly unpack the sand every time it is raised after a blow.

The butt end of the rammer should also be kept clean and bright for the same reason. And the face of the butt should not be quite flat, but it ought to have a slightly convex surface, so that it will pack the sand against the bars of the cope as well as downward. Less ramming with such a tool will suffice than with a tool having a perfectly flat surface.

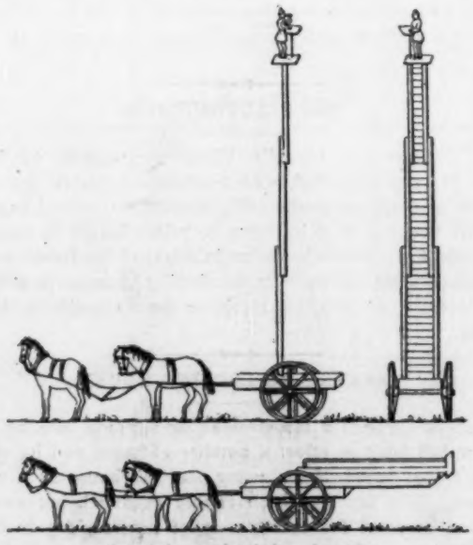
NEW ACETYLENE GENERATOR IN SWEDEN.

Mr. Erik Cornelius, chemist at the Carbide factory at Trollhattan, Sweden, has invented a new acetylene gas generator, called the "Trollhattan," states the Tradesman.

This generator is said to be much simpler in construction than former ones, and occupies little space. The falling of the carbide into the water is automatically regulated by a rubber ball, which, as soon as it is filled with gas, closes the valve between the carbide and the water. When the volume of gas decreases, the hollow rubber ball contracts, and the feed valve again permits the carbide to drop. The gas is stored partly in the rubber ball and partly in the space between the funnel-shaped carbide magazine and the water. If much gas is generated the water is pressed through valves into the water jacket in the sides of the apparatus, thus furnishing more room for the gas. A separate gas tank is therefore not needed. Should too much gas be produced, water and gas escape through a safety valve. Common carbide is used; no cartridges. The gas is dried by being allowed to pass through the carbide magazine, where the carbide absorbs the moisture. As there is no gas tank, and the quantity of gas stored thus is insignificant, it is considered that the fire insurance companies will, without raising the insurance premiums, approve of the apparatus, even when it is placed in dwelling houses.

MILITARY OBSERVATION PLATFORM.

This somewhat unstable looking device is a French invention for taking field observations where hills, high trees and balloons cannot be found. It consists of an extension ladder with a small platform at the top when raised. There are braces for



MILITARY OBSERVATION LADDER.

holding the ladder in position and cranks for raising not shown in the cut. When lowered it occupies a small space on a two-wheeled carriage and can be drawn over rough places by two horses. When raised the platform is about 50 feet from the ground.

CHEAP RATES TO CHICAGO AUTOMOBILE SHOW.

A rate of fare and a third on the certificate plan to Chicago from all points in the territory of the Central Passenger association, has been granted on account of the Chicago automobile show at the Coliseum. The territory embraces Southern Michigan, Illinois, Indiana, Ohio, Kentucky, Southern West Virginia, Virginia, Tennessee, North Carolina, South Carolina, Georgia, Alabama, Mississippi and Florida. Passengers will buy tickets at full rates on the way to Chicago and here will obtain a certificate which will enable them to obtain return transportation at one-third of the regular fare.

All exhibit space is already sold.

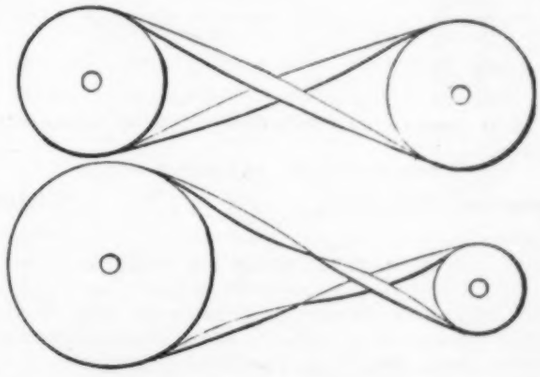
BOER PRISONERS EXPERTS AT MAKING TOYS.

Boer prisoners in the British camp in Burmuda are said to display wonderful mechanical genius in making toys. These are greatly in demand by the British officers and soldiers, who send them home to their families and friends as holiday presents. Boer-made toys are now all the fad in London.

Implements are furnished the prisoners free of cost and those who are adepts at toy making are given ample time to pursue their work. Frank H. Vizetelly of New York, when he visited the camp found one of the prisoners who was engaged in toy making, standing over a lathe driven by man-power, shaping a piece of cedar wood into some article that could be sold as a memento. "The variety of articles of this kind that the burghers make is almost endless," Mr. Vizetelly said in the Independent, "and comprises toys of all descriptions, anchors, giraffes, wooden chains, napkin rings, portrait frames, shoe-boxes from which serpent heads with pin fangs shoot out as they are opened, knives and forks, hammocks, miniature Boer houses and furniture, wagons of all kinds, also in miniature, and ranging from a prairie schooner to an ambulance. J. P. Kriel, formerly of Ladybrand, had on exhibition in camp a wonderful working model of a modern threshing machine for which he asked £10. Each article bears the name of the maker, and after having passed the censor, it is put on sale at a store in the city of Hamilton, known as the Boer of Toy Agency. This is conducted under the auspices of a society formed to furnish the prisoners an opportunity to make a little money and provide them with pastimes."

TO MAKE CROSS BELTS RUN SMOOTH.

What are usually known as cross belts are very common in driving machinery, and it is a well-known fact that they run best when the two pulleys which they connect are somewhere near of one size. But sometimes it is almost necessary to use a cross belt on pulleys of very different diameters, and it does not seem to be generally known how this may be done and still have the belt run smoothly. If the belt connects two horizontal shafts on the same level, and is given the ordinary single turn or twist, it will naturally stand in a vertical position at a point midway between the two shafts. Now, if the two pulleys are nearly of one size, this midway point is the natural crossing place for the two parts of the belt and all



goes well. But if one pulley is much larger than the other, then the belt must cross at a point much nearer the small pulley than the larger one, and with the ordinary twist the two parts of the belt are apt to quarrel, so to speak, at this point. To remedy this, in many cases, it is only necessary to give the two parts of the belt an extra twist as they pass from one pulley to the other. The belt then will stand vertical at two points, marking the thirds of the distance between the shafts, and if the pulleys are of such sizes that the belts cross at or near one of these points they will run smoothly again and with very little friction. The sketch shows the two positions.—American Machinist.

SPECIMENS OF TOYS MADE BY BOER PRISONERS.

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A "SAVINGS BANK ON WHEELS."

An "automobile savings bank," which has made its appearance in France is said to be one of the most brilliant ideas of modern times. The vehicle is propelled by electricity.

The car travels about the country making prearranged stops of an hour or two at the various villages. The passengers are two clerks of the treasury administration and a cashier. The third is empowered to receive moneys. The scheme is devised by the French authorities to encourage thrift among the peasantry. They decided to send the savings bank to the country folk instead of waiting for the latter to find time to come to the bank offices.

A POINTER ON DRILLING IN IRON.

Sometimes it is necessary to drill a hole in iron when making repairs to wood-working machines, says the Wood-Worker, and it is found that the drill is just a little too small for the size required. If a flat drill is used, it may be made to cut a hole larger than the width of the drill by grinding the center a little to one side, leaving the radius of one side longer than the radius of the other. If a hole is tapped for a bolt and the bolt is too tight, the threads can be opened by putting a piece of soft metal on one side of the tap and running it through again. Neither method is desirable when one has an outfit of tools, but either may help out in a pinch.

OIL FUEL FOR SHIPS.

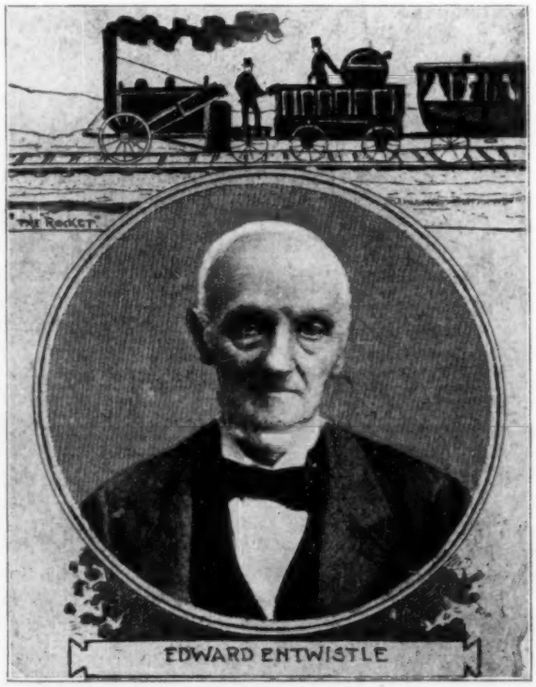
A few days ago the British steamship Clam arrived at Philadelphia from London, and earned the distinction of being the first vessel to cross the Atlantic with oil as its only fuel. The experiment has attracted widespread attention. The oil burning apparatus consists of a steam generator which atomizes the oil and sprays it into the furnace. Her boilers were of the ordinary return tubular type. The run of 3,300 miles was made in 28 days of stormy weather, but without any stopping of machinery. Russian oil was used coming over and Texas oil will take her back. Eighteen tons of oil were used per day where 28 tons of coal would have been required. English shipyards are already getting ready to equip other vessels in the same manner. No harder work exists than stoking the ocean greyhounds, in which occupation the men live only three or four years, and fuel oil will come as a welcome relief to many homes.

RAN THE FIRST PASSENGER TRAIN.

Edward Entwistle, of Des Moines, Iowa, Enjoys the Distinction.

The engineer who held the throttle on the engine that pulled the world's first passenger train now resides in Des Moines, Ia. His name is Edward Entwistle and he is 86 years old. The engine was the "Rockett," of George Stephenson, and it ran between Liverpool and Manchester, a distance of 31 miles. Entwistle was 16 years of age, says the Roadmaster and Foreman, when Stephenson had completed his plans.

The Rockett was built to enter a competition for a prize of £500, offered by the government for a high speed engine. When Stephenson was ready to enter the competition in September, 1830, he found himself without an engineer. Entwistle was



recommended by the Duke of Bridgewater, the lad being a machinist in the duke's machine shops.

Entwistle said: "The Rockett pulled five small coaches, that looked like stage coaches. Thousands of people were lined up along the railroad track to witness the strange performance. The speed maintained was 14 miles an hour." Entwistle ran the engine steadily afterward. Later he turned his attention to the sea, and for years he ran a steamship engine on the great lakes, residing in Chicago.

LACE EFFECT IN PINKING.

An unique idea in the finish of a large newel post for the Erie railroad is a lace effect in the finish, made by using pinking irons for the ornamenting of the recessed moldings. Some of the irons used were square, others round, and some fluted. The whole effect is very handsome and one can almost say that a woman had something to do with designing the pattern. The work of pinking was all done by hand and required the greatest of care to get the "pinks" of the same depth all over, or the effect would be spoiled, any unevenness of the depressions showing plainly when the work was finished in oil.—The Wood-Worker.

Easy Electrical Experiments

FOR BOYS.

ELEMENTARY STUDIES IN ELECTRICITY.

PART II.

BY L. P. DICKINSON.

In setting up the battery described in the preceding paper, fill the tumbler about two-thirds full of the solution, place the zinc and carbon rods in the solution, and join the cells in the manner described—that is, join the zinc pole of the first cell to the carbon pole of the next, and so on. Cells joined in this way are said to be in series. In order to show the effects of the electric current, two or three simple experiments will be described.

In an ordinary tumbler prepare a very weak solution of salt in water. Run a piece of bare copper wire from the zinc pole of the first cell to the tumbler of water, fastening it so that it will dip into the water a little way. Run another wire from the carbon pole of the fourth cell, and dipping into the tumbler of water, but not touching the first wire. If the battery has been set up as directed, there will be seen in the water, bubbles of gas which rise from around the wires. This may be most plainly seen by placing the tumbler between the eye and the light. Break the circuit by disconnecting the end of the wire connected to the zinc pole of the battery. It will be noticed that the bubbles cease instantly. Upon touching the wire again to the zinc, the bubbles again appear. Clearly then, there is some process going on in the tumbler of water, which is caused by the passage of some invisible agent from the battery through the wires to the tumbler. That which is flowing in the wire is the electric current. The bubbles of gas seen rising through the water are hydrogen and oxygen, of which the water is composed.

The electric current passing through the water decomposes it—that is, separates the hydrogen and oxygen. We shall learn at some future time how the effect just described is turned to good use in the storage battery.

Another experiment showing the magnetic effect of the current is very interesting. Procure a small pocket compass such as may be bought for about twenty-five cents, consisting of a magnetic needle about one inch long, swinging freely on a pivot at the center of a circular scale. Such a needle if left to itself will point nearly north and south. Having placed it upon a piece of board resting on a table, drive two wooden pins into the board about six inches apart.

Adjust the board and the compass so that a wire stretched between the two pins will be parallel to the needle, and about one-half inch about it. Connect the north end of the wire just mentioned to the carbon pole of the battery, and the south end to the zinc pole.

Note carefully the position of the compass needle before and after making the final connection. It will be found that when the wire is connected so that a current flows through it, the needle is deflected so that its north end points to the east of north. Try the same experiment when the wire connecting the pins is lowered so as run beneath the needle. Also try the effect of reversing the connection of the wires running to the battery. Finally wrap a piece of fine insulated wire several times around the outside of the compass case, turn the latter until the needle is parallel to the wires, and try the effect of connecting the terminals of this coil to the battery.

In all these cases there is an effect produced upon the needle by the current, this effect increasing with the number of turns of the insulated wire around the compass case. The experiments just described will help the student to understand the action of the following simple instrument, for the detection of weak currents.

Procure a block of whitewood, two and one-half inches square, and one-half inch in thickness. In its center bore a hole just big enough to receive the case containing the compass already mentioned, and deep enough to allow the compass to sink in until its top is even with the upper surface of the block. On one edge of the block cut two slots, each one-half inch in width and three-eighths inch deep. The centers of these slots should be five-eighths of an inch from the corners of the block. Do the same with the edge of the block directly opposite to this one. In these slots wind ten layers of No. 24 double cotton covered magnet wire, as shown in Fig. 1. These are the coils which are to carry

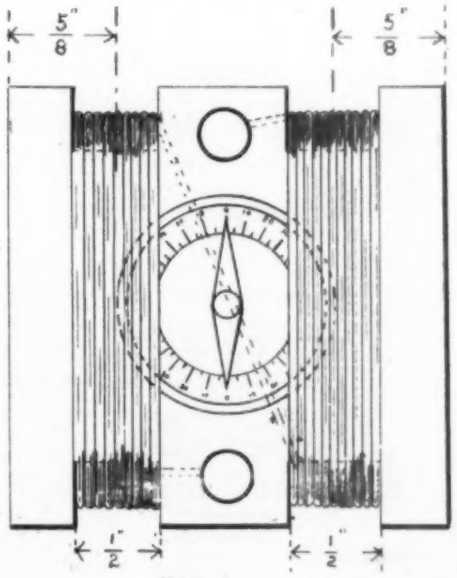


FIG. 1

the current and which are to act upon the needle, causing it to deflect when a current passes through them. Beginning with the left hand coil, wind it over and around the block until the required ten layers is obtained, then cross the wire on the under side of the block over to the right hand slot, and without breaking it, continue winding in the second slot *in the same direction* as the first coil was wound. Some difficulty may be found in keeping the layers evenly wound, especially at the middle of the coil. It may be necessary to bind the turns of each layer together by wrapping a thread around them at this point, before winding the next layer. The even winding of each layer is essential to the good appearance of the completed instrument.

When the second coil has its ten layers neatly wound, fasten the beginning of the first coil and the end of the second to two small binding posts. To enable the instrument to stand firmly upon a table, glue four cleats one-half inch thick to the under side of the board, one at each corner. Give the whole board and the coils two coats of brown shellac, and our instrument is complete. Such an instrument is called a galvanometer, and is a very useful piece of apparatus. There are many other forms of galvanometer, but their consideration must be left for another paper.

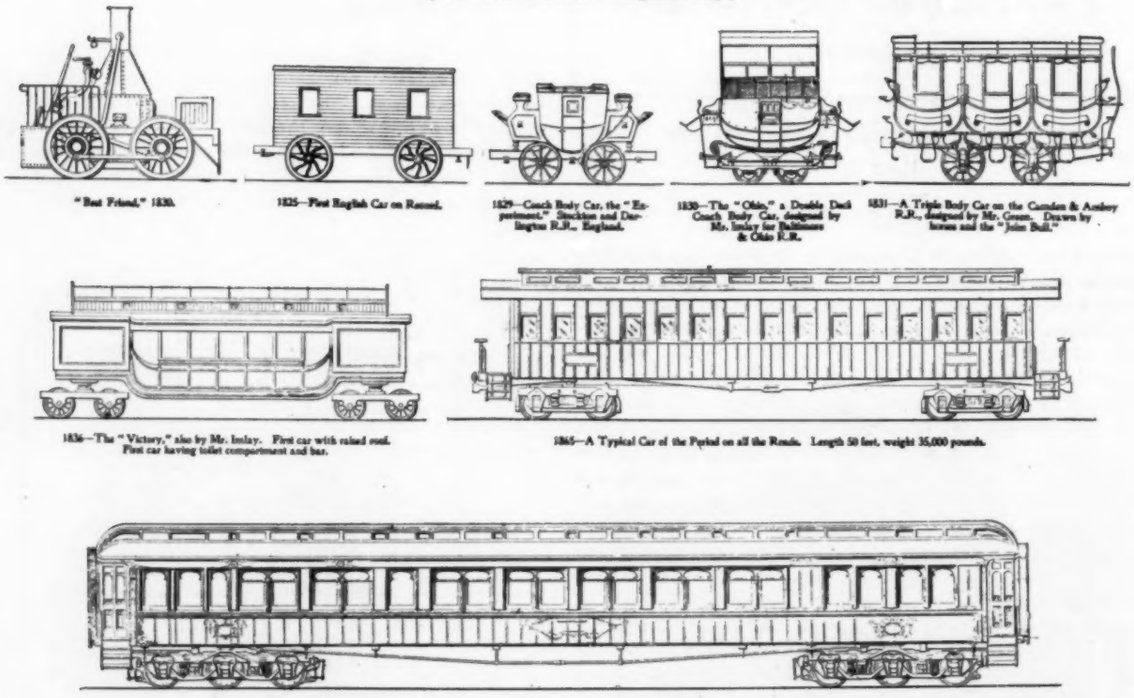
(To be continued.)

In Russia a person must secure a permit to carry firearms, and also another if he wants to sell the weapon.

The nearest approach to perpetual motion may be found at Alma, Mexico, in a silver mine which is very wet. At the mouth of the mine the streaming water falls perpendicularly for 100 feet to a turbine wheel which actuates a dynamo of great power. This dynamo generates an electric current which in turn is carried back to motors in the mouth of the mine which operate the pumps.

PICTORIAL HISTORY OF CAR BUILDING.

(From Locomotive Engineering.)



"Best Friend," 1830. 1825—First English Car on Record. 1829—Coach Body Car, the "Experiment." Stockton and Darlington R.R., England. 1830—The "Ohio," a Double Deck Coach Body Car, designed by Mr. Imlay for Baltimore & Ohio R.R. 1831—A Triple Body Car on the Camden & Amboy R.R., designed by Mr. Green. Drawn by horses and the "John Bull."

1836—The "Victory," also by Mr. Imlay. First car with raised roof. First car having toilet compartment and bar. 1865—A Typical Car of the Period on all the Roads. Length 50 feet, weight 35,000 pounds.

Late Sleeping Car. Length 72 feet, weight 100,000 pounds.

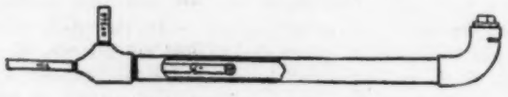
FLOATING DRY-DOCK A SUCCESS.

The test of the great floating dry-dock, built in Baltimore and towed to New Orleans, was made at New Orleans a few days ago and proved a success in all respects. The test was made with the man-of-war Illinois, the largest vessel in the United States navy, and was under the supervision of a board of naval experts, including Capt. Richard Pearson Hobson. The contract called for the dock to lift the Illinois out of the water in two hours and 40 minutes. The work was accomplished in one hour and 57 minutes. The machinery worked well and the vessel was lifted evenly.

BURNS CRUDE OIL OR TAR.

Charles Hughes has devised a novel burner for either crude oil or tar, a description of which he furnished to the "Wrinkle" department at the meeting of the Pacific Coast Gas Association. Mr. Hughes states:

"It is constructed entirely of pipes and fittings, such as are



HOME MADE OIL BURNER.

found around all gas works and machine shops. The larger or outer pipe, being ¾ inch by 18 inches long, is screwed into a tee. Through the straight opening of the tee, which is bushed down to required size, a ¼-inch pipe is screwed, which enters into the ¾-inch pipe about 6 inches, and is capped as shown in the drawing. This cap has an opening in the form of a cross, which is filed or sawed through the end to allow of the flow of oil. The large pipe carries on its furnace end an ell, plugged. A slot is filed or sawed of the proper size for the size of the flame desired. The steam is admitted to the large or outside pipe through the side opening of the tee, as per drawing. The author of this drawing has had excellent results from the use of this burner; in fact, much better than were obtained from some of the expensive burners on the market, the cost of the burner being comparatively nothing."

PORTLAND CEMENT FOR WALL PLASTER.

The value of Portland cement for plastering is not fully appreciated by the building public. When properly used with good lime putty it makes the best mortar for brick, terra cotta and wooden walls where 1-inch or 1½-inch lath are used. Since it has been found that the Portland cement is being manufactured in the United States of as good quality and at much less expense than the imported, builders will find it an important factor in making a good wall plaster for business blocks, public buildings and dwellings. It not only adds strength to the wall but makes it more dense and adds much to the value from a sanitary point of view.

Our modern way of heating and ventilating buildings causes atmospheric changes which are hard on the plaster, and what are known as the hard or patent plasters have proven unsatisfactory on account of the heat and moisture they are subjected to.

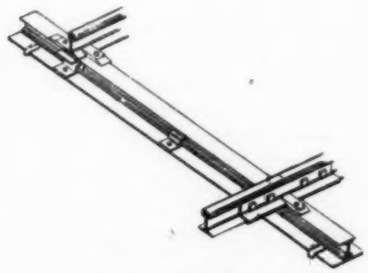
Most of these plasters are manufactured from sulphate of lime which sets from water of crystallization and disintegrates on account of these atmostpheric changes. Where Portland cement mortar is 70 per cent carbonate of lime it will get stronger with age. Portland cement mortar will not shrink or crack on the walls if it is properly troweled and floated. It can easily be worked so as to be solid and compact, which is impossible with lime mortar.—H. P. Van Hook in Municipal Engineering.

ACCIDENTALLY TAP A VOLCANO.

Workmen of the Indio Oil Co. accidentally tapped a volcano while digging in the Colorado desert in South California, recently. The men had bored 500 feet when suddenly there was an explosion and a spouting like that which might have been produced by opening a mammoth bottle of champagne. The tools were blown from the well and it began to spout hot mud and steam with tremendous energy. Luckily the men were enabled to escape from the derrick before the spouting reached its greatest force. Volcanic substances were showered about the surrounding country. Later it was discovered that volcanic conditions appear at several places in the vicinity of the well.

TIES FROM OLD RAILS.

The consumption of railroad ties in the course of a year is something enormous. One firm alone sells enough ties every year to lay a single track line from Boston to San Francisco. While large quantities are needed for new roads, the greater part go to replace worn out ties. Several attempts have been made to make metal ties, but so far with no great success. The most

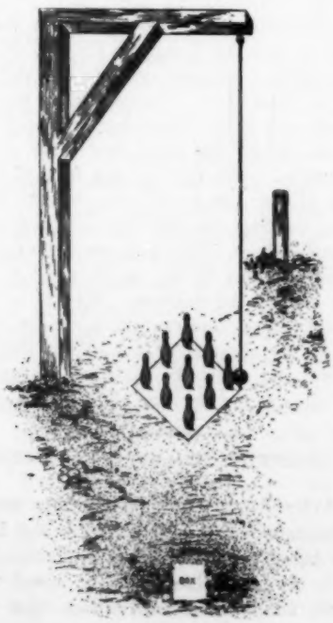


THE BUHRER TIE.

recent is described in the Roadmaster and Foreman (Nov.), and is the invention of C. Buhrer, of the Lake Shore road. An old rail weighing 65 pounds to the yard is cut to desired length and inverted. Underneath the rail and clamped to it is a steel plate ¼ inch thick by 8 inches by 8½ feet. This forms the tie to which the track rail is held by clamps.

SWINGING BOWLING.

Swinging bowling is being introduced from Germany where it is very popular. The apparatus is inexpensive and can be



easily erected by anyone having a few simple carpenter's tools, and there is room in nearly every factory yard. By choosing sides it affords fine sport during the noon hour, and really requires more skill to make a good score than might be imagined.

Our illustration, taken from the Florist's Review (florists are famous bowlers) gives a good idea of what the alley looks like. The rules gverning this game are as follow: The party bowling is to stand in what is called the box, with one foot therein, but may change his feet from right to left, as he may see fit, in order to get certain pins. The ball should swing around the pole on the right side and knock the pins down on the return.

In order that the bowling be perfect the dimensions have to be very accurate; otherwise some individual pins may be either taken too readily or not at all. The pin nearest the ball is the hardest to take; therefore one-quarter of an inch variation is a very important matter. The rope goes through the ball, leaving about three inches of rope underneath for the purpose of handling.

IRON PAVEMENT IN LONDON.

It is not generally known that it was once proposed to try iron as a paving material in London. An experiment took place in Blackfriars' road in 1816, but the idea of substituting iron for stone in the city streets was not carried out. Some forty years later an iron pavement was laid down at Paddington station, and shortly afterward this material was introduced in the now demolished King St., Westminster. It was durable and clean, but it never made any progress in public favor. Its chief defects were two: It did not wear evenly, and if horses fell upon it they were certain to be somewhat seriously injured.—Municipal Engineering.

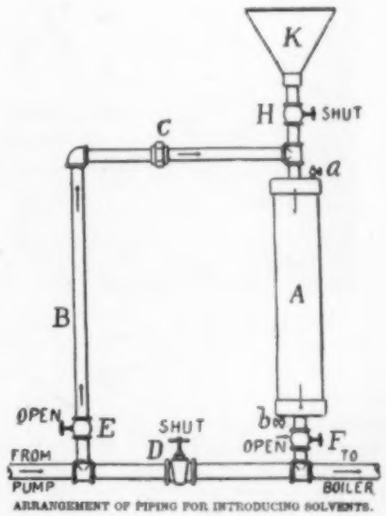
WHY RATS GNAW LEAD PIPES.

A querist in Domestic Engineering sets at naught the generally accepted theory of writers on sanitary science that rats gnaw lead pipe because they are thirsty and want to get to the water inside. The writer has discovered, from observation, he claims, that the rat gnaws the pipe simply because it is in his way and from the same cause that he gnaws a piece of wood or anything else that is necessary in digging his little tunnel-like passageways.

"I have even seen the statement," says the writer, "that rats will gnaw supply pipes to get at the water. I have seen Mr. Rat at work and a more surprised rat you never saw than when he cut through the pipe and the water gushed out. He scurried away as though a dozen cats were after him. In all my experience in the plumbing business (and I have been at it over thirty years) I have never seen a pipe gnawed except where it goes through floor or ceiling."

INTRODUCING SOLVENTS INTO BOILERS.

Our illustration shows a simple device, which any engineer can easily construct, for pumping solvents into the boiler without passing through the pump. Referring to the illustration, A is a section of big pipe—say 6 inches in diameter and 30 inches long—which is to serve as a reservoir. This connects with the feed pipe running from the pump to the boiler, by



ARRANGEMENT OF PIPING FOR INTRODUCING SOLVENTS.

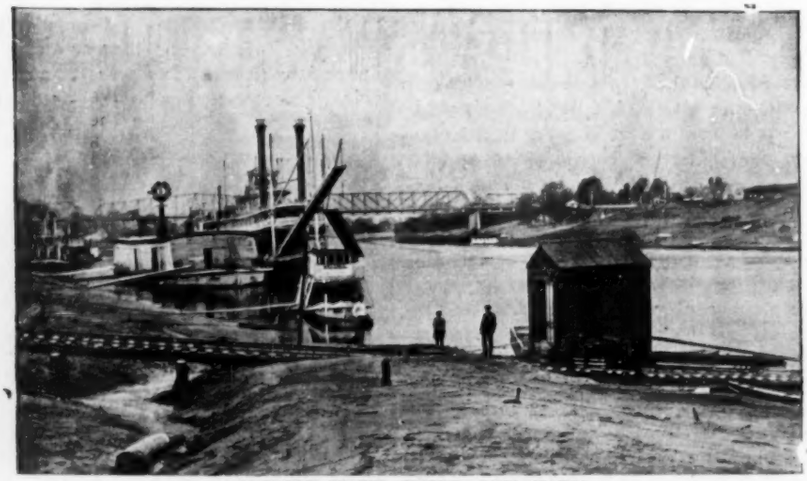
means of the pipes B, C and F, which are so arranged that they connect with the feed pipe on opposite sides of the stop valve D. Over the reservoir is a funnel, K, by means of which the reservoir, A, can be filled through the valve H. The reservoir, A, is provided with pet-cocks, a and b, at the top and bottom, so that it may be readily filled and emptied. A union is provided at C, to facilitate the assembling of the piping. (A right-and-left elbow, of course, may be used instead, if it is preferred.)

The device is used as follows: The reservoir A being empty, valves E and F, and pet-cock b, are first closed, and valve H and pet-cock a are opened. The soda ash solution is then poured into K, until the reservoir A is filled. The valve H and the pet-cock a are then closed, as well as the valve D, in the main pipe. Valves E and F are then opened, and the pump is started. The device is then in the condition shown in the engraving, and the water from the pump passes through B, C and A, as shown by the arrows, sweeping the contents of A out into the boiler.

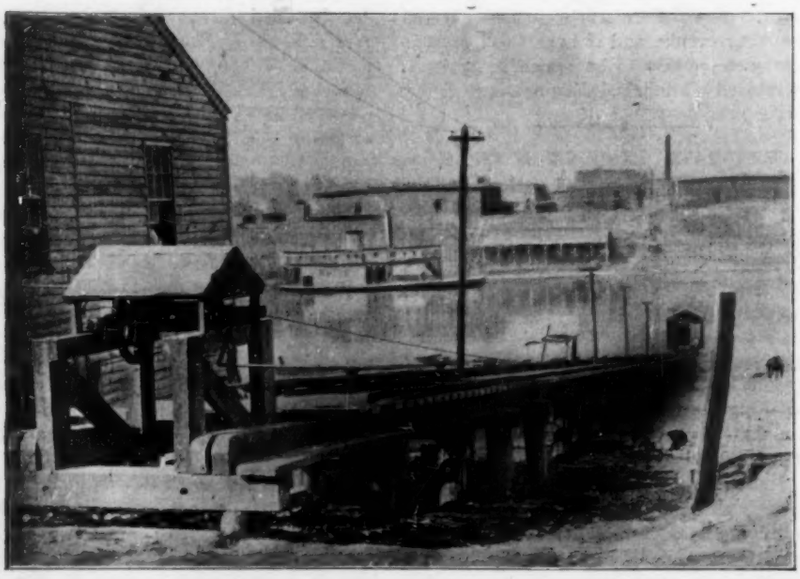
When the pump has been run long enough to thoroughly remove all soda ash from A, valve D may be opened, and valves E and F closed. The reservoir A is then emptied by opening pet-cock b and either pet-cock a or valve H, and the device is again ready for operation.—The Locomotive.

A MOVABLE WATER WORKS.

One of the strangest water works plants to be found may be seen at Monroe, La. The source of supply is the river, which at this point varies 40 feet in height between wet and dry seasons of the year. It was necessary to take the water from near the surface, but the surface of the river is very uncertain. An ingenious engineer worked out the following solution of the trouble: He built a tram line during low water which extended down to the lowest point known, and secured the track to wooden posts or piles driven several feet into the river bottom. On this track a car was placed containing a pump driven by an electric motor and covered by a shed. A pipe which can readily be taken apart to change its length as desired, leads from the pump to a point on the bank far above high water. Wires on poles as shown, conducts the electric current to the movable "plant." The pump is of 500,000 gallons daily capacity and was built and installed by the Goulds Manufacturing Co., of Seneca Falls, and has been in successful operation ever since it was put to work.



MOVABLE WATER WORKS—LOW WATER.



MOVABLE WATER WORKS—SHOWING INCLINE.

HOW TO SEW CARPET.

In sewing carpet, says the Furniture Journal, it will be found convenient to stretch a rope tightly across the room at a convenient height from the floor and stretch a breadth of carpet on each side of the rope with the edges, which are to be sewed together, just meeting above it. Fasten both breadths to the rope at one end by means of a small hand clamp, then stretch them as tight as possible and fasten with another clamp at the other end. This holds the carpet for you and leaves both hands free, and also prevents pulling one breadth more than the other and mismatching the figure.

REMARKABLE LONGEVITY IN IRELAND.

The registrar general for Ireland says that 20 per cent of the population of the island die of old age, and it would appear that that is not very rapidly fatal, as there were living there in 1900 212 men and women over 100 years old. Taking account of the emigration; of the drafts on the young men for military service which has always been favored by the Irish, and of this special vitality and longevity, it would seem that Ireland must be a country of old people par excellence. Another corroborative fact as to the general well-being of the Irish and the comparatively small proportion of young and productive individuals is the reduced birth rate which is a usual accompaniment of thrift and prosperity, and which is said to be lower than in any other portion of the British Isles.—Medical News.

HOW TO DISTINGUISH HAND-MADE PAPER.

To distinguish whether paper is hand or machine-made, cut out pieces in a circular shape about three or four inches in diameter, and place them in a basin of water so that they float on the surface. The machine-made paper will be found to curl up on two sides towards the middle, whereas in the hand-made paper the edge will turn up all round, like the raised edge of a plate.—London Linotype Notes.

A CHIEF'S CURIOUS MISHAP.

Chief Kennedy, of Green Bay, Wis., was nearly drowned while fighting a fire recently, says the Fireman's Herald. He had ascended a stairway and forced the door of an office open. The office floor was covered with nearly three feet of water. The flood swept the chief down the narrow stairway. The door at the foot of it being closed, the water rose against it and held it closed, and the entire stairway space was filled up. Realizing the desperate position he was in, he set to work to gain the head of the stairway. He had to climb twenty steps. He came to a window, from which he shouted orders to cut the door below and allow the water to escape, and a hole was cut through the heavy door.

REMEDY FOR VITRIOL BURNS.

A Frenchman has discovered a remedy instantaneous in its effects for the horrible burns caused by the use of oil of vitriol. It is soft paste of calcined magnesia and water, with which the parts burned are covered to the thickness of an inch. It alleviates the pain almost immediately, and when the paste is removed no scar remains.

A MAMMOTH ENGINE.

We illustrate an engine which is 37½ feet high, 41 feet across the front, 23 feet from front to rear; which contains more than 15,000 pieces and weighs 1,500,000 pounds. It is rated at 6,000 horse power, but will develop up to 10,000 under emergency. It drives a 5,000 kw. generator of the revolving field type, and goes into the power station of the N. Y. Gas, Electric Light, Heat and Power Co. It is the latest Westinghouse-Corliss cross-compound and is the largest ever built by the Westinghouse company.

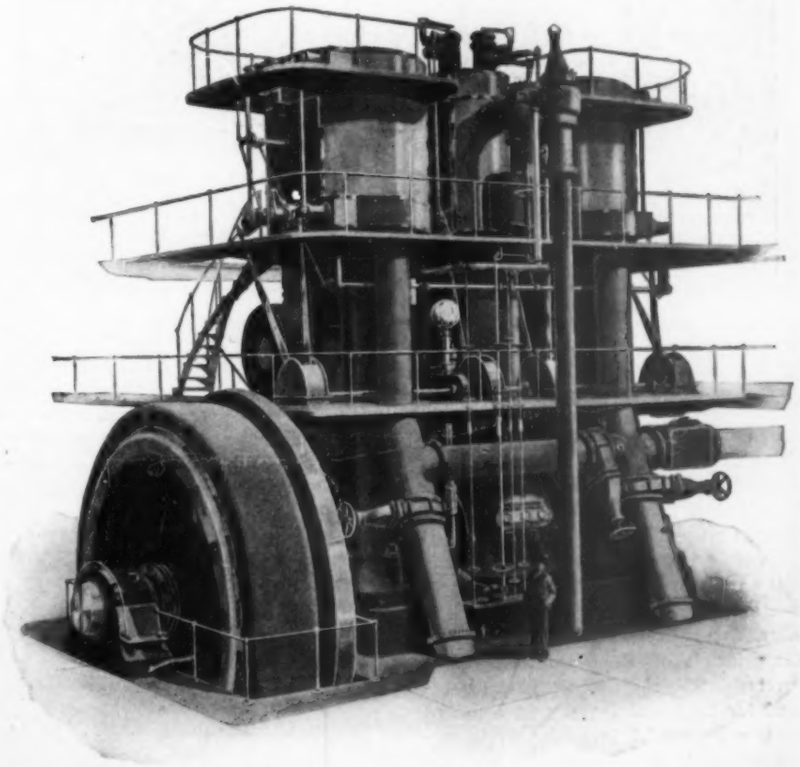
The base consists of three rectangular pieces weighing 100 tons, upon which are set the three housings with circular flange tops. Each housing, consisting of two parts which bolt together, is very stiffly ribbed. Bolted on the housings are the cross-head guide frames of which there is one for each housing. Each guide frame is surmounted by its cylinder, there being one high pressure between two low pressure cylinders. The high-pressure cylinder is 43½ inches in diameter, and the two low-pressure cylinders each 75½ inches in diameter. The stroke is 60 inches and the speed 75 r. p. m. The high-pressure cylinder is not jacketed, and from this cylinder the steam passes into a receiver 4 feet 6 inches in diameter and 23 feet long, having a volume of 210 cubic feet and containing 110 tubes with 1,200 square feet of heating surface.

The valves are all double ported, and as close together as will allow of proper valve gear construction. The high-pressure cylinder has balanced poppet valves actuated by a releasing gear, and the low-pressure cylinders Corliss valves operated by the usual wrist plate and tie rods. This unusual combination of valves was substituted for all Corliss valves because of the high temperature at which steam enters the high-pressure cylinder. This steam which is under a pressure of 175 pounds, is superheated 200 degrees, making its total temperature 577 degrees. At this temperature it is practically impossible to provide the efficient lubrication necessary to the proper working of Corliss valves.

Each connecting rod is a steel forging, and is 13 feet 9 inches long between centers. The top end of each connecting rod is of the ordinary solid type with wedge adjustment, and the bottom end is of the so-called marine type. The crosshead pins are 14 by 14 inches, and the crank pins, 14 inches in length, are 22 inches in diameter. The cranks are of cast steel, and are of the usual type, not as is customary, set 120 degrees apart, but at unequal angles, selected to give the best possible turning movement, which, owing to the service of the engines, is a matter of capital importance.

The main shaft is of open hearth, fluid-compressed, hydraulically forged steel, as are the connecting rods, and was supplied by the Bethlehem Steel Company. This shaft is hollow, 29½ inches external diameter, and 10 inches internal diameter at the wheel fit and 9 inches at the bearings. The total weight of the main shaft is 136,000 pounds.

The eccentrics controlling the valve motion are mounted on a lay shaft 6 inches in diameter, located at the level of the first platform, and driven by a spiral gear. The flywheel is made of five segments joined with I-links, and travels 5.416 feet per minute. An automatic stop-valve is closed by steam admitted through a three-way cock. In a pocket in the face of one of the high-pressure crank checks is pivoted a short weighted lever, balanced against centrifugal force at normal speed by a helical spring. Should normal speed be exceeded, the weighted lever flies out, and engages with a spring lever pivoted on the engine base. The action turns the three-way cock above mentioned, admitting steam to a chamber of the angle stop valve on the steam supply main, and this valve is promptly closed. There is also provision at a number of points about the engine for hand control of this same stop valve.



SIX THOUSAND H. P. WESTINGHOUSE ENGINE.

Poet (to friend who has been reading his verses)—"Well, do you think my style has finish?"

Friend—"Oh, yes. I think any one can see its finish."

BUILT FIRST; PLANNED LATER.

The bridge builder with Stonewall Jackson's army was a rare character, if the following story be true:

The Union soldiers, retreating from the valley of Virginia, burned a bridge over the Shenandoah.

Jackson, who wanted to pursue, sent for his old bridge builder. "Sir," he said, "you must keep men at work all day and all night, and finish that bridge by tomorrow morning. My engineer shall give you a plan."

Old Miles saluted and withdrew.

Early the next morning the General sent for Miles again. "Well, sir," said Jackson, "did the engineer give you the plan for the bridge?" "General," said the old man slowly, "the bridge is done; I don't know whether the picture is or not."

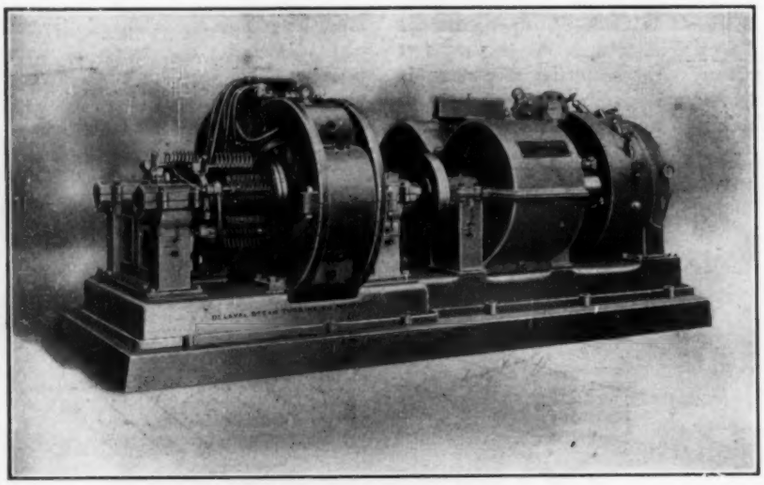
A PALMIST WHO COULDN'T PALM.

"Do you seriously believe in palmistry, Bob?"

"I do. A sweet little amateur palmist held my hand for half an hour the other evening and told me that I was going to fall in love in about twenty minutes and ask the lady to be mine and be accepted, and the whole thing came true before I got out of the chair."—The Record-Herald.

THE DE LAVAL STEAM TURBINE.

The successful operations of steam turbines under the crudest conditions, says the Railway and Engineering Review, prove their simplicity and durability. The simplicity of construction is evident, the wearing parts being the bearing only. They



SHOWING CONSTRUCTION OF TURBINE.

are well adapted for use in the upper stories of buildings. As there is no reciprocating motion the balance is perfect and no foundations are necessary except for carrying the weight of the heavier machines. The space occupied is very small and its compactness reduces the cost of building, transporting and erecting as well as the weight and cost of repairs. The turbine is particularly well adapted for direct connection to dynamos, centrifugel pumps, blowers, fire-engines, etc.

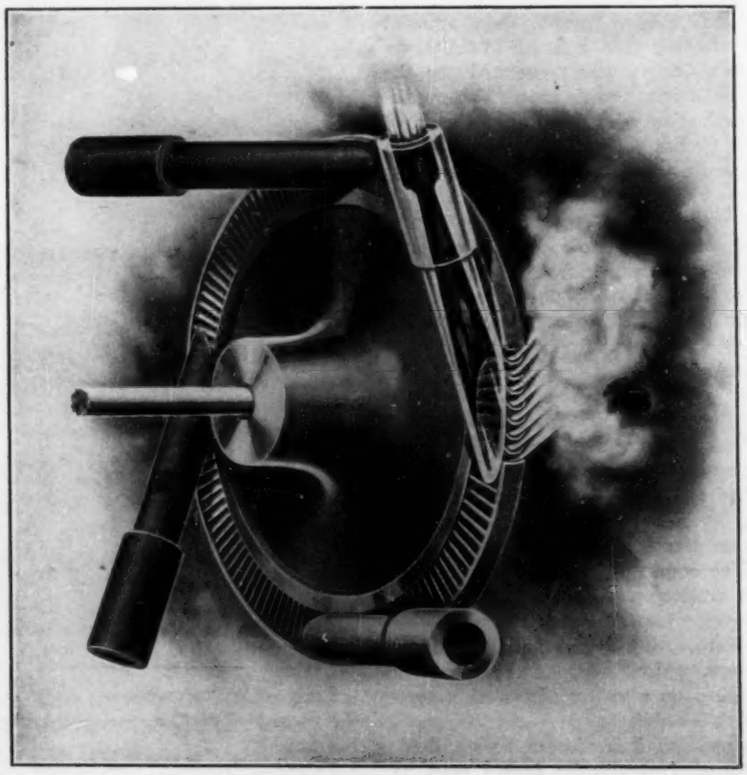
The principle of the steam turbine was discovered before the steam engine. It remained for De Laval in 1883, however, to produce a successful invention. His turbine was used in direct connection with the shaft of a cream separator. By use of the diverging nozzle he secured a complete and adiabatic expansion of the steam and the conversion of its entire static energy into kinetic. To overcome the impossibility of producing a wheel accurately enough balanced to revolve about its center of gravity at a velocity sometimes as high as 1,350 feet per second, without causing a side pressure destructive to plain bearings and a rigid shaft, he produced a flexible shaft.

The De Laval nozzle and flexible shaft, regarded as among the most remarkable inventions in steam engineering, have placed the steam turbine in the foremost rank among heat motors. Since their advent thousands of machines, in size from three horse-power to 300 horse-power have been built.

In a properly constructed nozzle, a volume of steam of maximum pressure entering gradually and—as every element of the nozzle assumes a temperature constant and equal to that of the passing steam—adiabatically expands to minimum pressure and as this pressure is that of the surrounding medium the steam at the point of discharge issues in a solid jet without tendency of its particles to divert in any direction. Prof. Zenner has shown that theoretically the work of this adiabatic expansion converts the entire static energy of the steam into kinetic, and that the stored energy of a jet of steam issuing from a De Laval nozzle is identical to the amount of work produced if an equal volumne of steam is allowed to adiabatically expand behind the piston of a cylinder and at the same ratio of expansion—the diagram ending in a point.

The steam turbine can, as far as mechanical results are concernel, be operated equally well with low pressures and noncondensing, and even then successfully compete with the reciprocating engine, but for the best economy, high pressures and a condenser should be used, and as the difference and gain in economy in the case of the steam turbine is more marked than in a reciprocating engine, it will be found in many cases, even for comparatively small sizes, of advantage to operate condensing, even in places where the scarcity of water would render the employment of a cooling tower necessary.

A characteristic feature of the De Laval steam turbine is that none of its running parts are subject to the full pressure of the steam, as the steam is fully expanded in the nozzles before it reaches the turbine wheels. This feature is of great value and promising future in the direction of using high pressures with resultant increases in economy of fuel. The restriction as to the steam pressure that can be used is found only with the boiler. The turbine itself has been operated with a pressure as high as 3,000 pounds per square inch. Further and considerable increase in economy can be obtained by using superheated steam, for which it is particularly well adapted, it having no rubbing parts requiring lubrication, or packing glands in contact with the superheated steam, and as in the case of high pressures, even here the limit exists alone with the boilers.

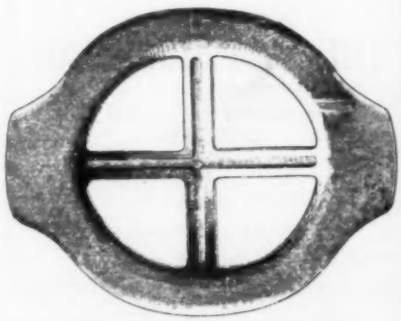


TURBINE DRIVING GENERATOR.

AN IDEAL VACCINATION SHIELD.

Experience of ten thousand vaccinations has caused Dr. C. P. Franklin, of Philadelphia, to invent what he considers a perfect vaccination shield. In the Journal of the American Medical Association Dr. Franklin says:

"The shield is made of aluminum six centimeters in diameter to the outer edge of its flange, which latter is curved so that it presents no sharp edges but a broad



smooth surface to the arm, and is extended at each end into a tab or projection by which it is fastened to the arm with short narrow strips of plaster. The central part, or dome, is 4.5 centimeters in diameter and is raised above its base one centimeter being composed of two ribs, crossing at right angles, each rib being strengthened by a beading or groove, so that it will stand an ordinary pressure."

NEW THING IN ACCIDENTS.

"Big 'partment-house fire!" piped the newsboy with the armful of papers. "Many lives saved!"

The novelty of the thing took. In ten minutes he had sold out.

WHY HE AGREED.

"I think," said the old-fashioned member of the school board, "that we ought to pay more attention to writing."

"So do I," said the Harvard graduate unexpectedly. "Teach 'em all to write plain—plain as print."

"My boy," said the old-fashioned member after the meeting, "what made you agree with me so enthusiastically?"

"Why, you see," said the youth with hesitation, "I—I proposed to a girl last month, and she sent me her answer in writing, and—and, hang it, I don't know whether she said no or yes!"—Washington Times.

"Man wants but little here below"—
The line's familiar to us all.
A good man wrote it long ago—
He didn't know Pierp. Morgan, though,
Or "Yim Hill of Sant Poll."
—The Record-Herald.

CHICAGO - TEXAS OIL SYNDICATE

Capital Stock, $1,000,000.00 in shares of 50 cents each
Full paid and non-assessable

OFFICERS AND DIRECTORS—President, W. C. Moore, President of the Moore-Cortes Canal Co., Houston, Texas; Hon. Wm. E. Mason, United States Senator from Illinois; Perry A. Hull, Master in Chancery of the Circuit Court, Chicago; Treasurer, O. C. Drew, Cashier Planters' & Mechanics' National Bank, Houston, Texas; S. R. Perryman, Attorney, Houston, Texas.

REFERENCES—Chicago National Bank Chicago, Ill.; Planters' and Mechanics National Bank, Houston, Texas; The First National Bank of Beaumont, Texas

WHAT THIS SYNDICATE OFFERS

It owns 437 acres of the choicest oil lands in Texas. Its first well on Spindle Top Heights, Beaumont, is now nearly completed. There are one hundred and ten gushers within a stone's throw of it—on every side. This well would have been completed before this except for the fact that for four weeks the drill was in the hardest rock yet struck on Spindle Top, and it took three weeks' drilling, night and day, to get through this forty-foot stratum. This was finally penetrated and the drill is now sinking rapidly. A gusher may be expected daily. This hard rock is an excellent indication of a big deposit of oil beneath it.

In addition to the Spindle Top Heights property, the Syndicate owns 400 acres at Sour Lake (within a few hundred feet of where a gusher has been struck), at Dayton Prairie, at Saratoga and elsewhere. Gushers are now in at Saratoga and Sour Lake and flowing perfect lubricating oil, making the proven oil fields of immense value. These lands are all paid for and owned outright by the Syndicate, therefore there are no leases and no royalties to pay.

A GUSHER GUARANTEED WITHIN THIRTY DAYS

This Syndicate guarantees a gusher on Spindle Top Heights within 30 days. A limited amount of treasury stock is offered for sale at 50 cents per share in lots of 50 shares and upwards. Money now subscribed for stock will be refunded directly to the subscriber if the Syndicate has not a gusher within 30 days. Out of town subscribers may deposit subscriptions in their local banks and notify this company at the address below.

MARKETING ARRANGEMENTS MADE

The demand for Texas oil is world wide and enormous. The only problem is to get the oil to the market. This problem has been solved by the Syndicate.

This Syndicate has just bought 20 acres of tankage ground, with 1,000 feet frontage on the railroad (The Texas and New Orleans Branch of the Southern Pacific), only 1½ miles from Spindle Top. This will give trackage for 30 tank cars that can be loaded at one time. Tanks and a pipeline from the Syndicate's wells to its tanks and loading racks will be built at once. This will give the Syndicate unexcelled facilities for marketing the products of its wells.

With these arrangements made, as soon as a gusher comes in, the property will be greatly enhanced in value, and

The price of the stock Will at Once Advance and will thereafter continue to go up rapidly ON MERIT ALONE

It is now offered at par—50 cents per share—the ground floor price. Dividends will be paid as soon as earnings begin. That time is not far off—BUY NOW. The company is managed by men of recognized ability and known integrity.

No preferred stock—all shareholders on absolutely the same basis. When you buy and pay for this stock you can never be to any more expense. It can never be assessed.

Send requests for extended prospectus, remittances for subscription or any information to

$25	buys	50	shares
$50	"	100	"
$100	"	200	"
$200	"	500	"

Fidelity Trust & Investment Co.,

511 B Stock Exchange Bldg., Chicago

CLEANING WITH OIL.

The Railway Review, Dec. 14th, describes a new method of cleaning passenger car trucks, which can easily be adapted to other similar work. A mixture composed of

Two parts crude coal oil and

Three parts Coalinga and crude oil

is sprayed with a paint atomizer. Then the object sprayed is wiped with waste. The mixture penetrates all parts, leaves the surface looking like new, and can be done rapidly.

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"Want" and "For Sale" Ads. 10 cents per line payable in advance. Replies may be sent to a number, care Popular Mechanics, and will be forwarded promptly without extra charge.

HELP WANTED.

WANTED—Stark Nursery pays cash weekly if you sell Stark trees. Dansville, N. Y.

WANTED—Patternmakers (metal). Apply Chicago Malleable Castings Co., West Pullman, Ill.

WANTED—Agents for a new gaslight burner; fast seller. Eureka Supply Co., Crookston, Minn.

WANTED—Engravers (wood); two good men, two years' steady work guaranteed. Star Engraving Co., corner Broadway and Market streets, St. Louis, Mo.

WANTED—Diemaker, a first-class man on combination dies; wages and references. Address G. A. Crosby & Co., Ltd., Sarnia, Ont.

WANTED—Harnessmaker, steady work for a sober and good mechanic. E. Bratton, Le Roy, Ill.

WANTED MOLDERS, 25 to 50 bench molders. The Haven Malleable Castings Co., Cincinnati, Ohio.

CARRIAGE & WAGON WOOD WORKERS wanted. W. H. Gabriel & Son, 50 Michigan street, Cleveland, Ohio.

WANTED—A good wood-working machine hand; must be familiar with variety machine work. La Rose Mfg. Co., 172 Broadway, Albany, N. Y.

WANTED—Experienced weavers; also learners; also learners; young women preferred. Mayhew Silk Manufacturing Co., J. J. Huckley, Superintendent. Old Silk Mill, Ninth Av. and Twenty-fifth St., Altoona, Pa.

DRAUGHTSMAN—Architectural draughtsman; must be good on full size detail; permanent place for right man. William W. Sabin, 708 New England Bldg., Cleveland, Ohio.

WANTED EXPERIENCED CANVASSERS—Should clear $5 daily. Illustrated mechanical weekly, entirely new idea. Send references. Popular Mechanics, Journal Bldg., Chicago.

WANTED AT ONCE—A first-class tinner; a man who can do all kinds of inside and outside work; only strictly temperate tinners need apply. W. Reinhardt & Sons, Lincoln, Ill.

WANTED—Expert bread and cake baker for Illinois city. Must have best of references. Good wages and steady work. All communications confidential. State wages wanted and your age. Address 1905 Broadway, Mt. Vernon, Ill.

WANTED—Experienced stove salesman for Northern Illinois. Send references; apply by letter. Bergstrom Bros. & Co., Neenah, Wis.

WANTED—Good, sober, all-around tinner and plumber who can put up wind mills and not afraid to work. Answer, stating wages expected. Newtson & Seaver, Hoopeston, Ill.

WANTED—Good house and sign painter and paper hanger. Must be sober and steady. State salary. Address Anton Popelar, Dodge, Neb.

WANTED—Salesman, to sell our coal-saving device to house owners; can be applied to furnaces or steam heaters; selected lists of names and attractive proposition. Western Aeolipyle Co., 134 Lake street, Chicago, Ill.

WANTED—Window trimmer, first-class; state salary expected and experience. G. M. Barrett Co., Department Store, Milwaukee, Wis.

WANTED—Agents in every county and town in the United States to sell a harness snap—"a snap that is a snap." Expense of outfit small, profits large; splendid side line for traveling men to sell to dealers or consumers; an opportunity for any one to make money. Address C. M. Beard, Elroy, Wis.

WANTED—Stove salesman. State age, experience and salary wanted. Danville Stove & Mfg. Co., Pittsburg, Pa.

WANTED—Competent solicitors, new proposition. Agents are making $5 a day. Address R. 604, 160 Washington street, Chicago, Ill.

WANTED—Canvassers. No trouble to secure subscriptions to Popular Mechanics. Agents are coining money. Write at once. Popular Mechanics, Journal Building, Chicago, Ill.

POSITIONS WANTED.

ENGINEER, competent on steam and electric plants, wants situation. Hunter, 108 Morris avenue, Newark, N. J.

WANTED—Situation; general all around machinist; no objection to leaving city. Address J. M. Graham Seabrooke, Dayton, O.

POSITIONS WANTED.

WANTED—Position in hardware store; 5 years' experience; 2 years in tin shop. Prefer small town. Any part of country. Address J. O. Harney, Lawton, O. T.

SITUATION WANTED—By Engineer; steady and sober; experienced on ice machine; best references; city license. J. E. Riley, 302 Chestnut street, Chicago, Ill.

WANTED—A position as tinner at once; have had 4 years 'experience at in and outside work; can do furnace and bicycle work. Can give good references. Address P. O. Box 131, Lakefield, Minn.

SITUATION WANTED—As an apprentice in a jewelry store to learn trade, by a young man of good moral habits and mechanical turn. Address E. O. Carver, Henry, Ill.

FIRST-CLASS STEAM ENGINEER, now employed, desires change for good reasons; technical education, boiler tests, indicator work and economical operating of a modern power plant. Address 15 days, Engineer, care of Engineer, 10 Paulina place, Chicago, Ill.

WANTED—By young married man, position in retail hardware; capable of taking entire charge, experience, best references. Address H. T. Cornell, care C. W. Hackett Hardware Co., St. Paul, Minn.

WANTED—A man of 18 years' experience in the hardware line, desires a position either as traveling salesman or manufacturers' agent for a general line of stoves and furnaces, or a general line of hardware. Would like to sell on commission in Michigan; thoroughly reliable and can furnish best of references. Address K., 420 McCullum street, Bay City, Mich.

BUSINESS CHANCES.

FOR SALE—One double saw mill complete with 60 and 30 saws. Address G. W. Startle, Osborn, O.

FOR SALE—Second-hand steam, gasoline, electric vehicles. Guaranteed. A. L. Dyke, Linmar Bldg., St. Louis, Mo.

TANKS WANTED—Anyone having iron tanks of 3,500 to 5,000 gallons capacity for sale, is requested to address X. Y. Z., Box 72, Albany, N. Y.

WANTED STOCKS OF GOODS and all kinds of machinery, tools, store, office fixtures, etc. T. P. Westropp & Co., 305 Pearl St., Cleveland, Ohio.

FOR SALE—The Automobile Storage and Repair Co., 57 West 66th St., New York, have new and second-hand steam, gasoline and electric carriages constantly on hand and have always some special bargains.

FOR SALE—One nearly new 5 h. p. gasoline twin-cylinder automobile motor, water cooled, for $125.00. One single cylinder, water cooled, automobile motor, for $100.00. No more at this price. H. L. Hoffman Motor Co., Plainfield, Ill.

WANTED—First-class second-hand stereopticon and graphophone, acetylene burner; for cash; must be the best and cheap. Write H. H. Kile, Foss P. O., Ill.

WANTED—To sell, a good live business, situated in the mountain town of Divide, 27 miles west of Colorado Springs, and 18 miles north of Cripple Creek; stock and fixtures, $5,000; should have a capital of $10,000; pays net profits of $500 per month. Address George W. Sadler, Divide, Colo. Good reason for selling.

TO SPECULATORS—60 per cent on your money; savings banks pay you 3 per cent or 4 per cent. Why not investigate to-day? Profits payable 1st and 15th of month. Write for inside information. C. M. Bragaw & Co., 99 Nassau street, New York.

FOR SALE—Exceptional opportunity to purchase profitable manufacturing business near Chicago; dignified proposition, doing large business; reason for selling, advanced age of directors. Odlum-Kurtzman Co., Minneapolis, Minn.

TO CLERKS, SALESMEN, RAILROAD men, shop and factory hands, etc.—Loans on easy terms, quickly and confidentially. R. 840, 125 La Salle, Chicago, Ill.

FOR SALE—Photograph studio, one of the best paying in state of Indiana; beautiful county seat; ground floor; finely equipped; best location; business $350 monthly long lease; rent $20 four pleasant dwelling rooms furnished complete for housekeeping; everything new; all goes; snap; $700. Box 585, Monticello, Ind.

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